

Water-Energy Relationships



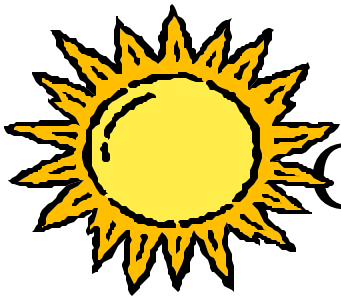
Lon W. House, Ph.D.

530.676.8956

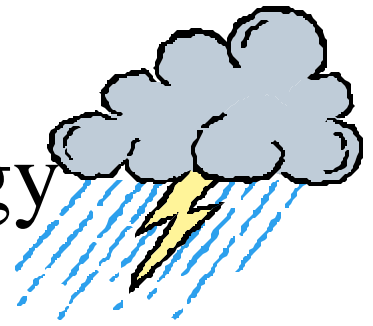
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Docket 04-IEP-1H

January 14, 2005



California Hydrology



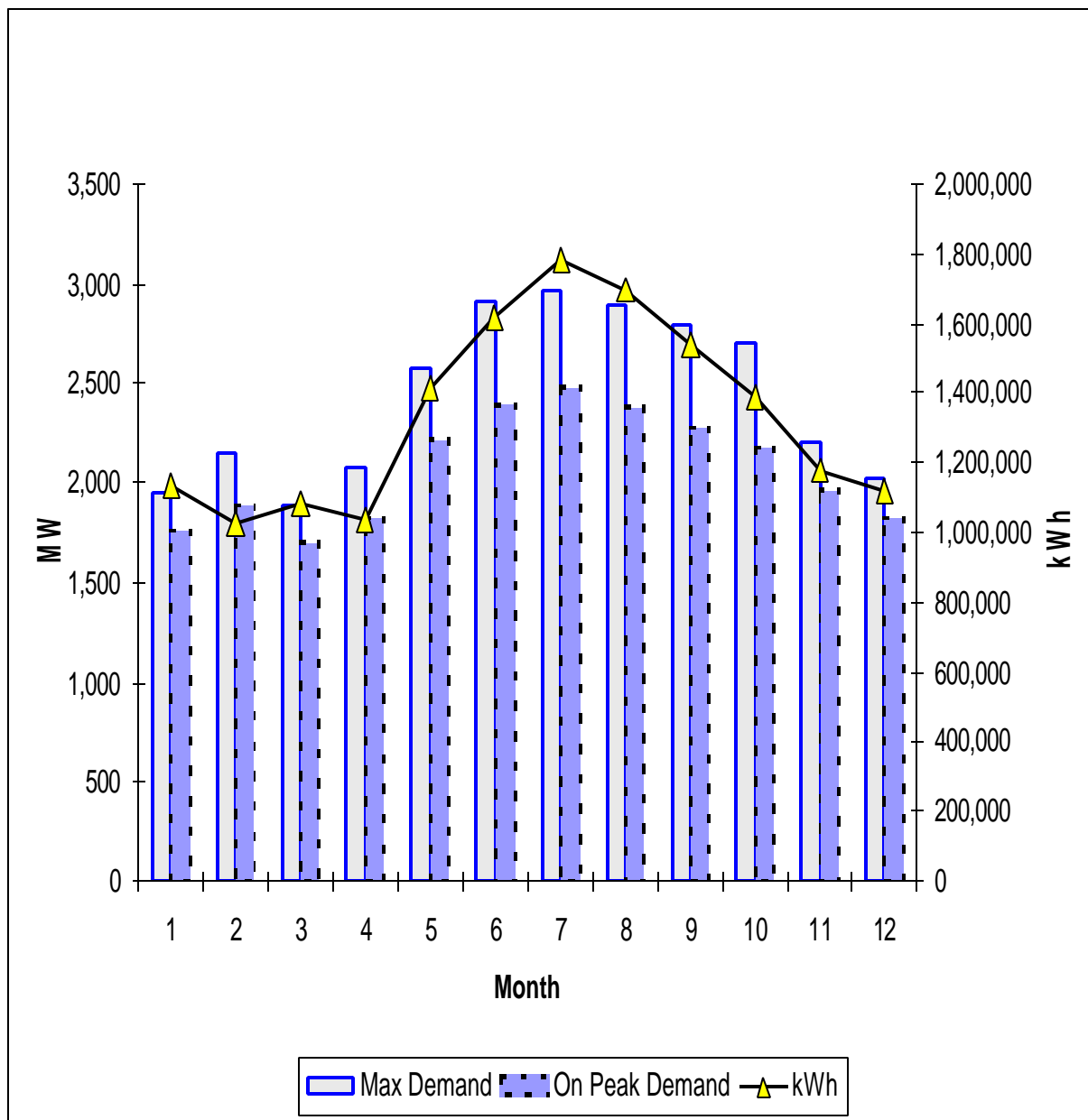
- 75% of rainfall occurs north of Sacramento
- 80% of use of water occurs south of Sacramento
- Mediterranean climate: 80% of the precipitation occurs from November to March. Most as snow, melts through August/September.
- Majority of water use is in summer
- About 71,000,000 acre-feet of water per year is runoff
 - flows to ocean - 36%
 - environmental flows - 28%
 - agriculture - 28%
 - urban/industrial - 7%
 - other - 1%



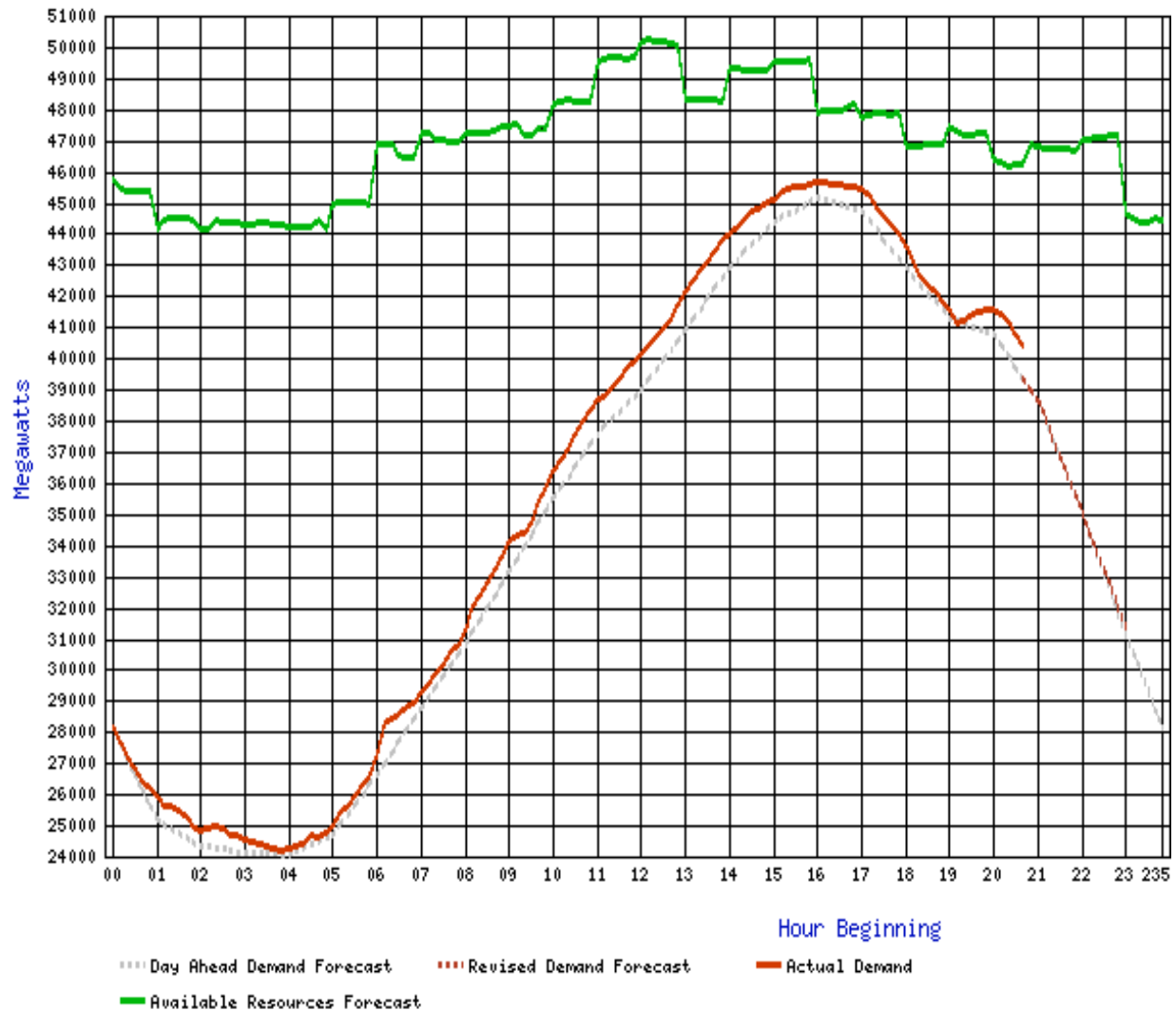
California Water System



Water Agency Electricity Requirements in California



September 8, 2004



Previous energy use record of 43,609 MW, set in July 1999.

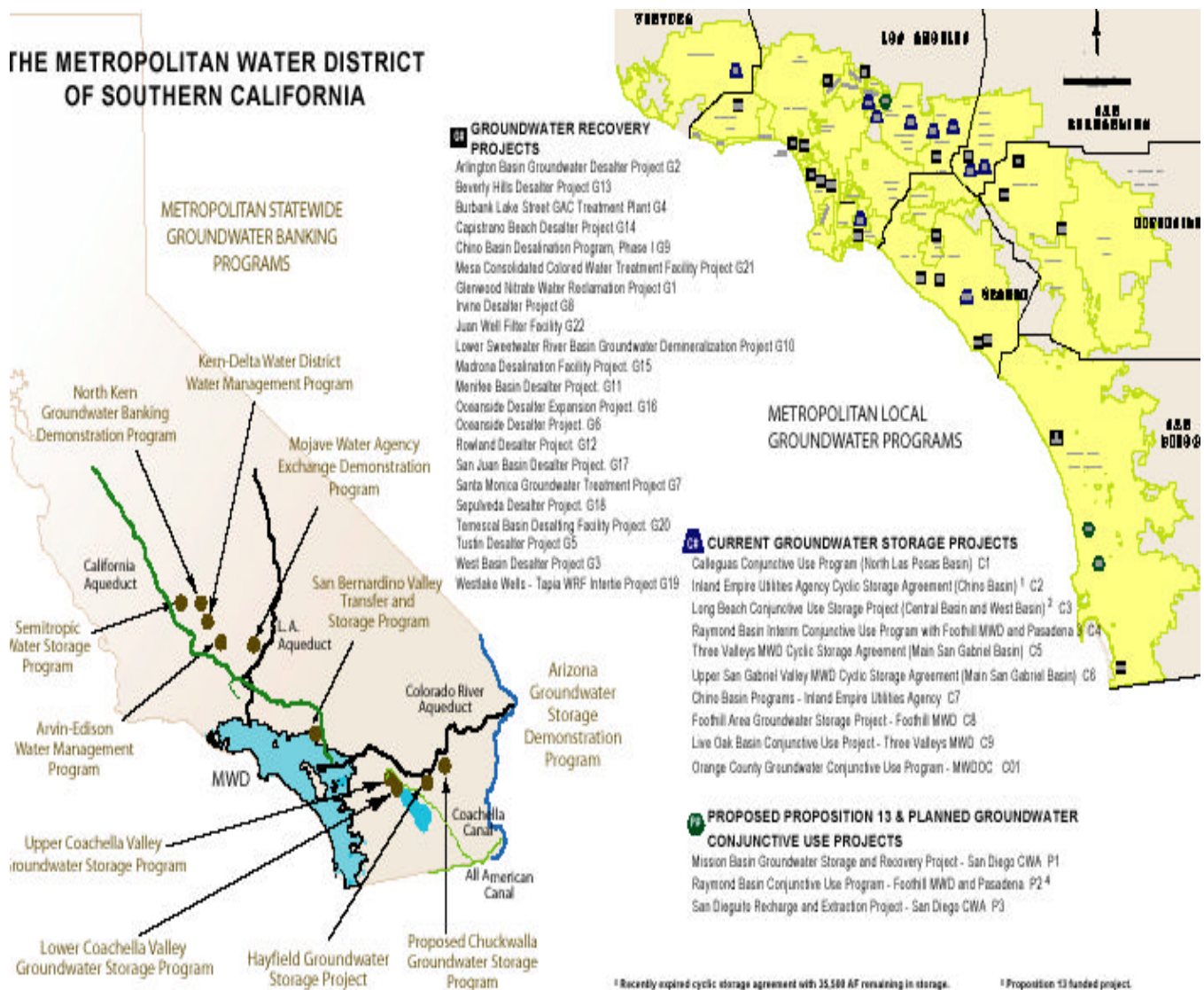
July 19 - 44,042 MW; July 20 - 44,330 MW; July 21 - 44,360 MW; August 10 - 44,497 MW; August 11 - 44,872 MW; September 7 - 45,165 MW; September 8 - 45,597 MW.

New Water Electricity Requirements

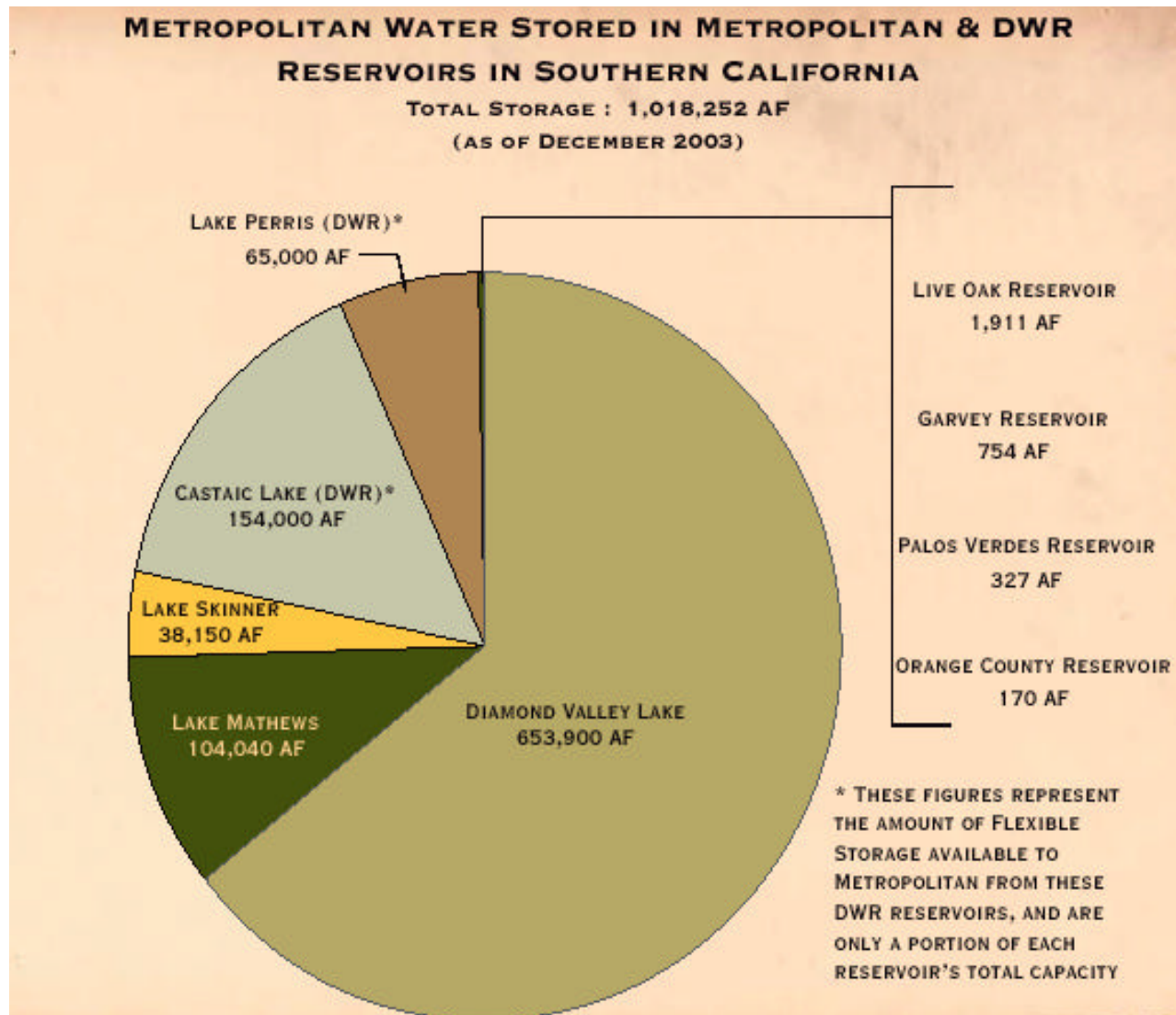
- Conjunctive Use Development
- Desalinization
- Drought/Climate Change
- Increased Treatment Requirements
- Increased Population



Conjunctive Use Southern California



MWD Above Ground Storage

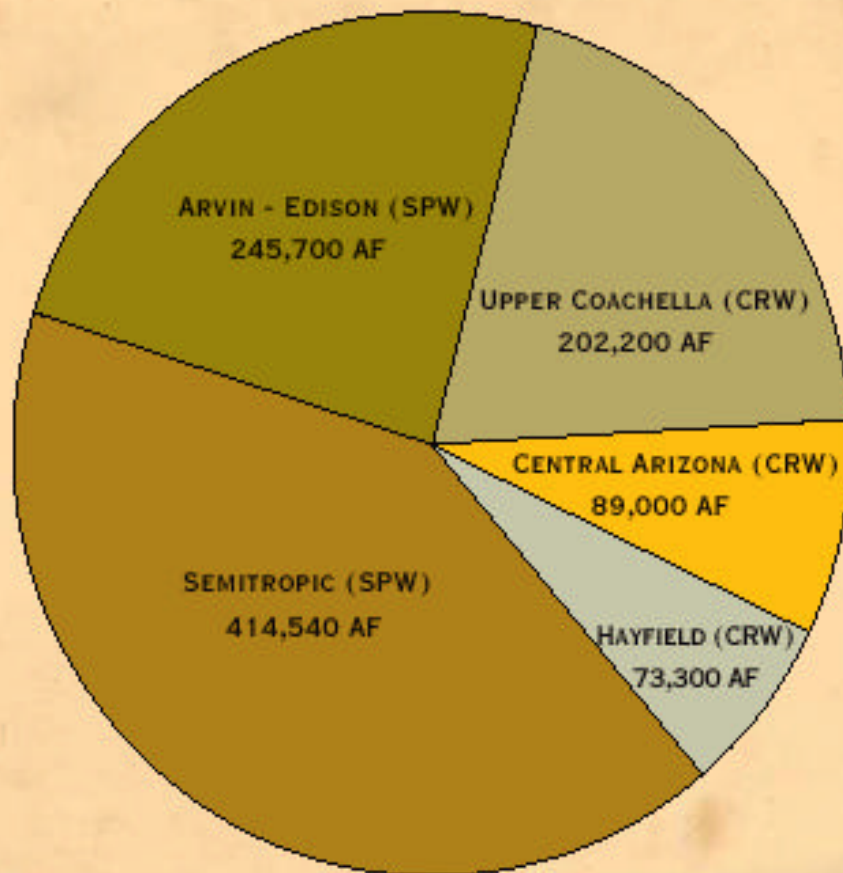


MWD Groundwater Conjunctive Use

METROPOLITAN WATER STORED IN GROUNDWATER BASIN OUTSIDE ITS SERVICE AREA (AS OF DECEMBER 2003)

TOTAL COLORADO RIVER WATER (CRW) GROUNDWATER STORAGE:	364,500 AF
TOTAL STATE PROJECT WATER (SPW) GROUNDWATER STORAGE:	660,240 AF

TOTAL MWD GROUNDWATER STORAGE OUTSIDE ITS SERVICE AREA: 1,024,740 AF



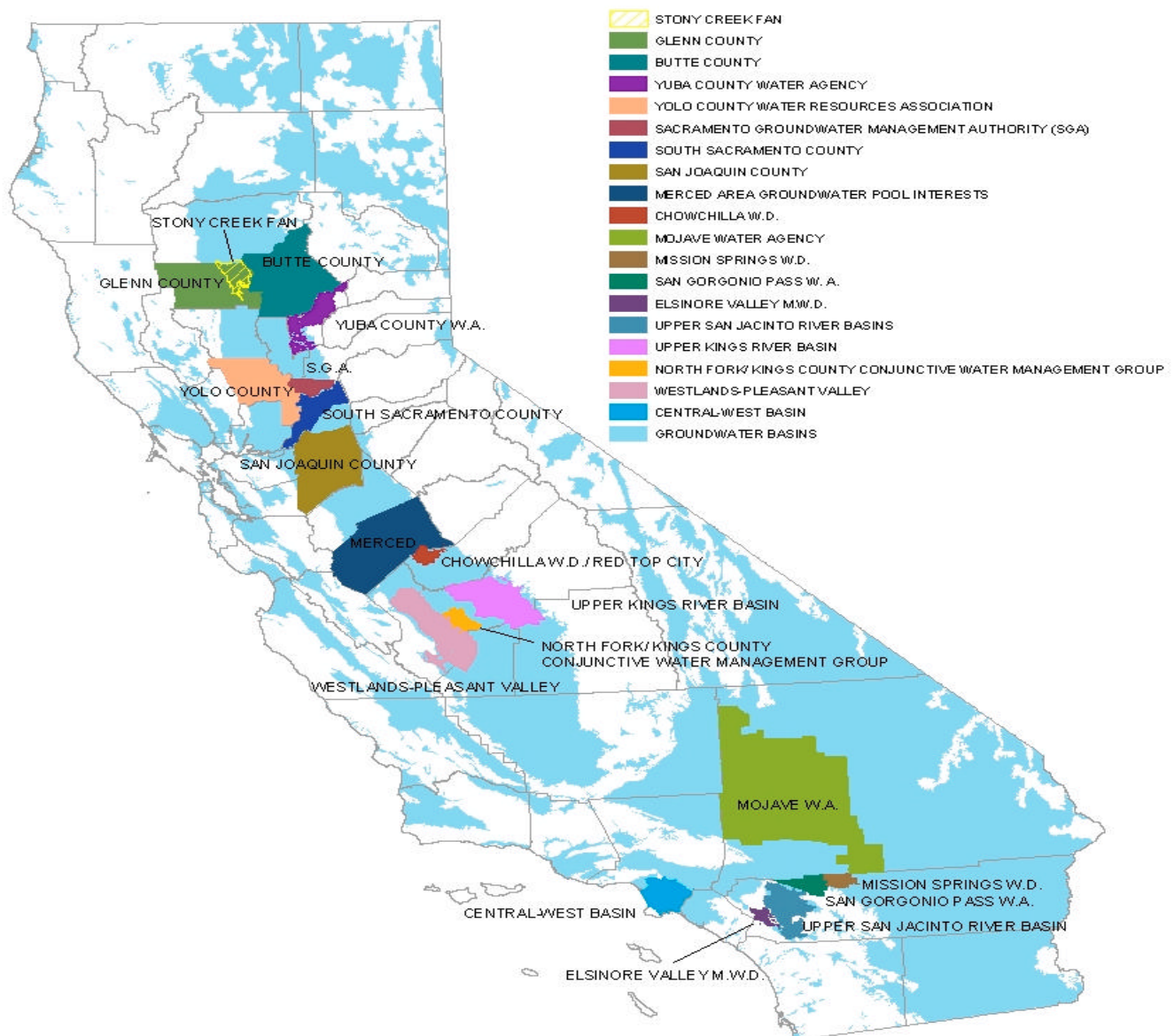
New Met Groundwater Storage Projects

- 5 New agreements for 192,000 acre-feet
 - Three Valleys Municipal Water District and the City of La Verne - Live Oak Basin
 - The City of Long Beach and Central and West Basin Municipal Water District
 - Central Basin
 - Foothill Municipal Water District - Monkhill Sub-basin of the Raymond Basin
 - Inland Empire Utilities Agency, Three Valleys MWD, and the Watermaster - Chino Basin
 - Municipal Water District of Orange County and Orange County Water District
 - Orange County Basin
- San Diego County Water Authority in the Raymond Basin for up to 75,000 acre-feet of storage.
- Calleguas Municipal Water District storage and extraction in the North Las Posas Basin in Ventura County. This program has been phased; phases 1 and 2 are scheduled to come online by 2005. Completion of facilities necessary for management of a 210,000 acre-foot storage program in this basin should be operational by 2010.



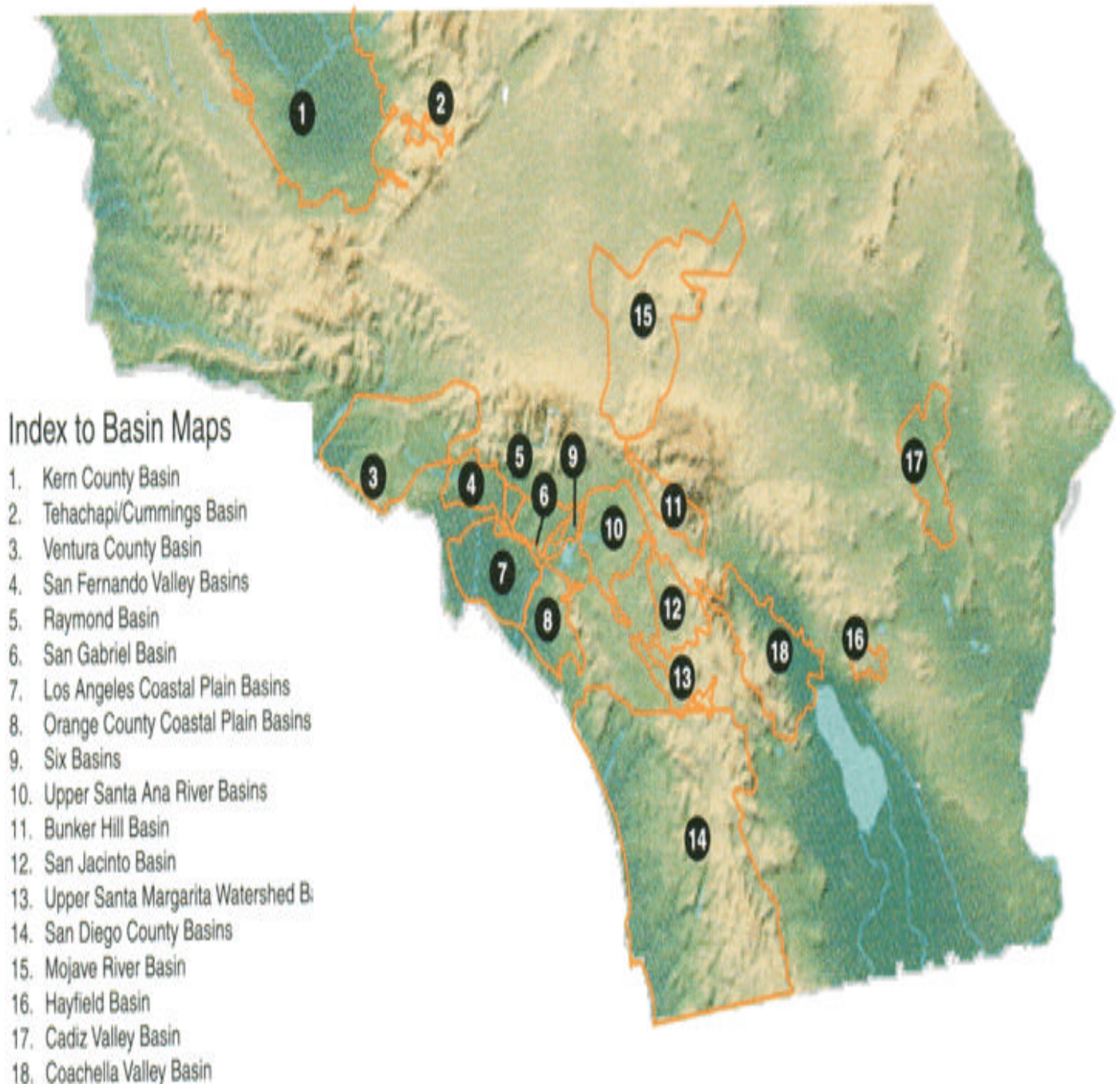
Conjunctive Use Sites Northern California

Department of Water Resources
Conjunctive Water Management Branch
MOU Partners



Potential Southern California Sites

21 million acre-feet dry year storage



Last DWR Supply Update

California Water Budget with Existing Facilities and Programs (maf)

	<i>1995</i>		<i>2020</i>	
	<i>Average Drought</i>		<i>Average Drought</i>	
	Water Use			
Urban	8.8	9.0	12.0	12.4
Agricultural	33.8	34.5	31.5	32.3
Environmental	36.9	21.2	37.0	21.3
Total	79.5	64.7	80.5	66.0
	Supplies			
Surface Water	65.1	43.5	65.0	43.4
Groundwater	12.5	15.8	12.7	16.0
Recycled and Desalted	0.3	0.3	0.4	0.4
Total	77.9	59.6	78.1	59.8
	Shortage			
	1.6	5.1	2.4	6.2

Seawater Desalination Facilities in California

- **Existing:**

- About a dozen small facilities along coast.
- Total production about 2.7 mgd.
- Generally for drought-relief, emergencies, industrial processes.

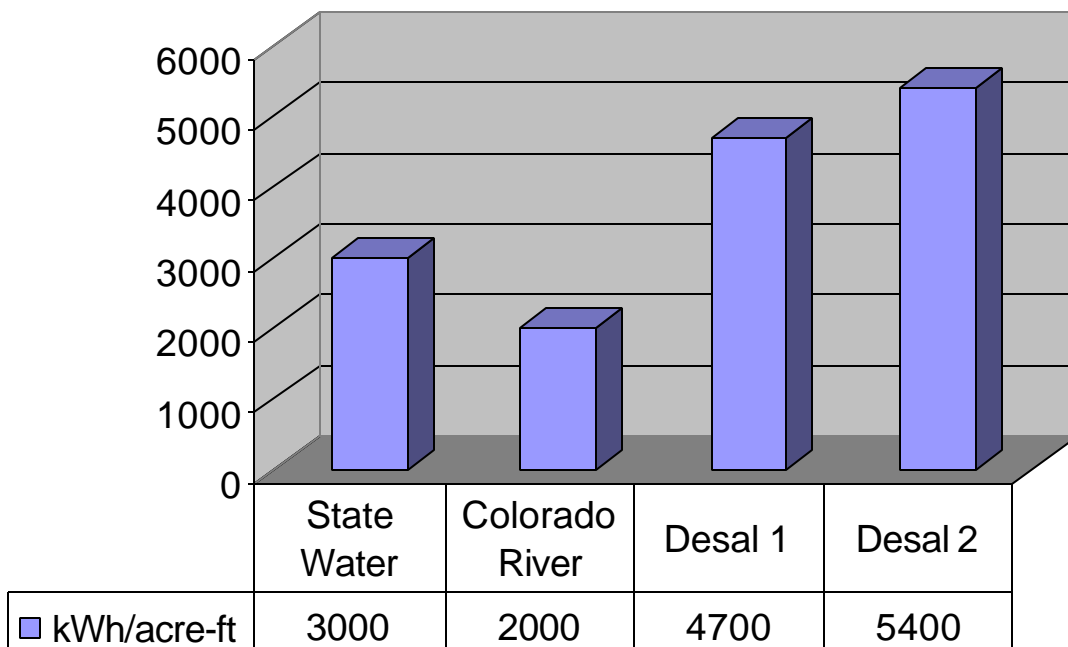
- **Proposed:**

- Over 20 new facilities; including largest in U.S.
- Total production about 250 mgd.
- To provide baseline water supply.

Desal Electricity Requirements

Each facility ~30-50MW

Water Energy Comparison kWh/acre-ft

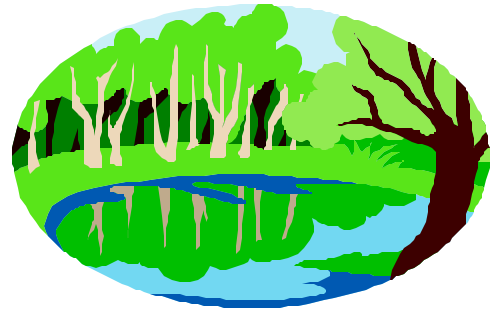


Drought Climate Impacts



- Climate change - snowpack reduction in Sierra could result in loss of 2.6 - 4.0 million acre-feet of water storage
- Drought in Southwest could seriously deplete the Colorado River, and California's share
- Drought/climate change will reduce quantity, availability, and timing of hydroelectric generation
- All remedies will require significantly more electricity use

River Characteristics



		Generation (in MW)		Runoff		Dry		County	Min cfs
<u>River</u>	<u>Water Agency</u>	<u>Generation</u>	<u>Utility</u>	<u>1000 Ave. AF</u>	<u>% Ave</u>	<u>% Ave</u>			
Pit/Fall			768	5,896	42%		Shasta	120	
Feather River			738	4,526	21%		Butte/Plumas	50	
Feather -South Fork									
	<u>Oroville-Wyandotte</u>	118	291	291	11%		Butte		
Yuba	<u>Yuba CWA</u>	396	12	2337	16%		Yuba	5	
Bear River	<u>Nevada ID</u>	80	208				Nevada/Placer	7	
American - North/Middle									
	<u>Placer CWA</u>	200	245				Placer		
South Fork									
	<u>El Dorado ID</u>	21	7	2,674	13%		El Dorado		
Mokelumne	<u>East Bay MUD</u>	39	209	736	31%		Amador		
Stanislaus	<u>TriDam</u>	96	100	1,131	14%		Tuolumne	38	
Merced	<u>Merced ID</u>	99	4	952	16%		Merced		
San Joaquin	<u>Friant Power</u>	25	221	1,753	21%		Fresno/Madera	23	
			1,014						
Kings	<u>Kings River</u>	165	345	1,647	23%		Fresno	4	
			1,200	Helms Pumped Storage			Fresno		
Kern River			12	694	25%		Kern	22	
Tule River			6	135	12%		Tulare		



Water Agency Peak Demand Reductions

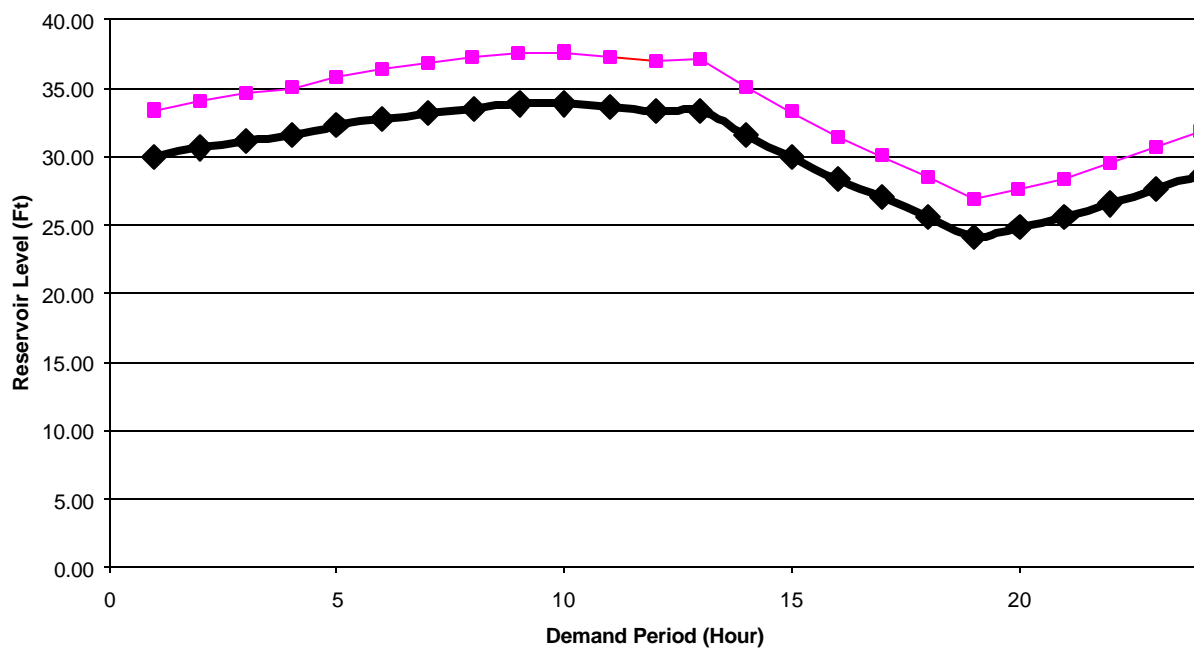
- More Effective Use of Storage
- Add More Storage
- Get Customers to Shift Water Demand



More Effective Use of Existing Storage

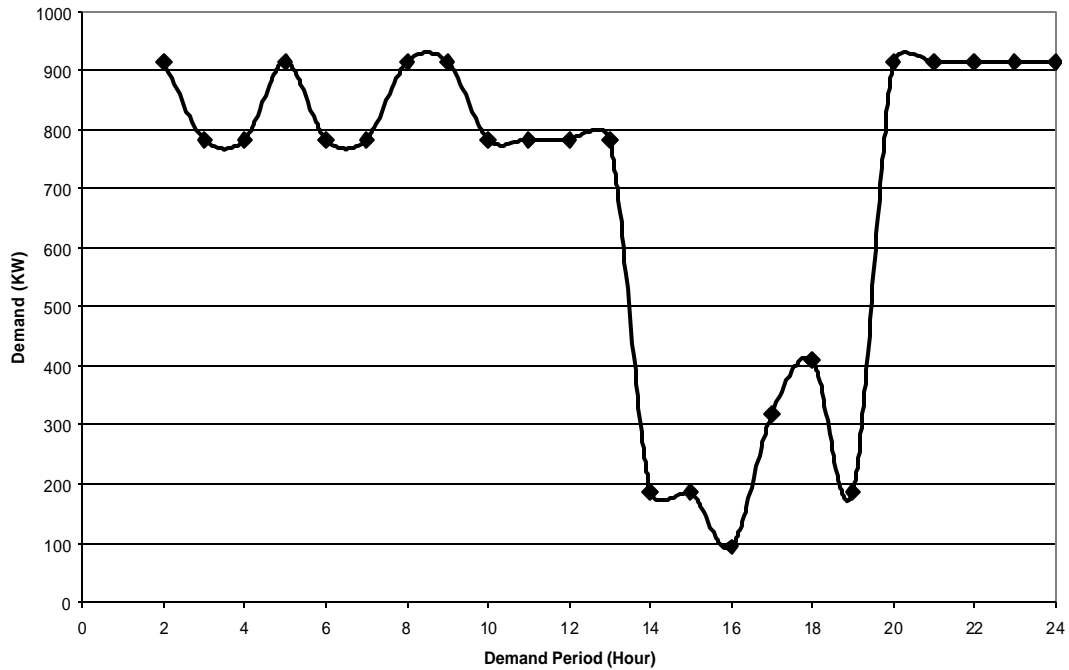
Hourly Reservoir Levels

Oak Ridge Tanks Storage (8 MGals - Total)

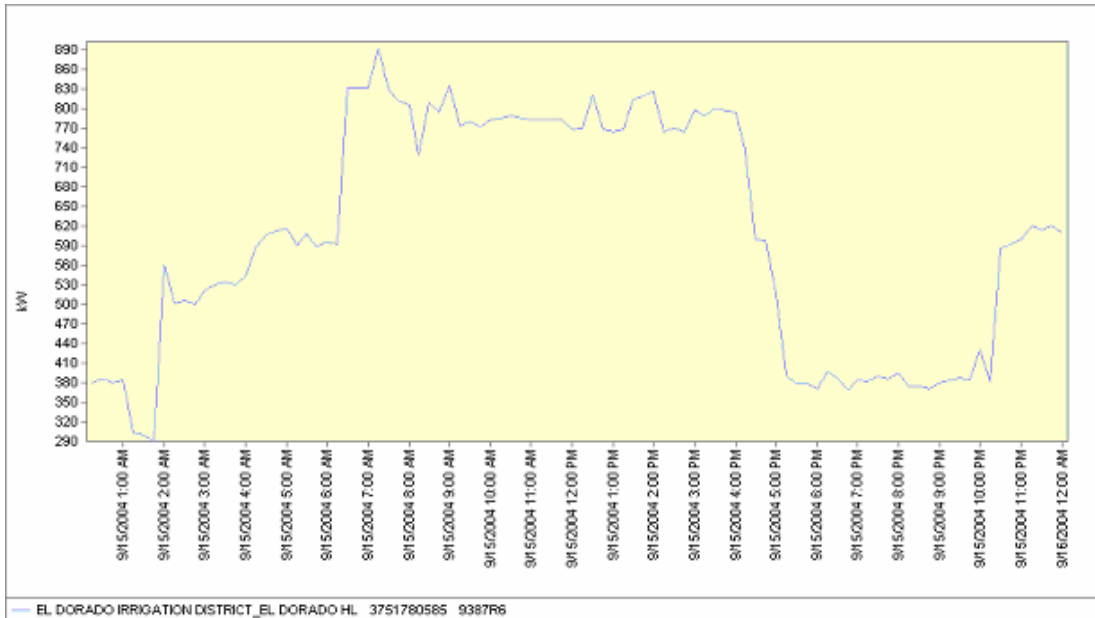


**Figure 5. Treatment Plant Hourly Electrical Demands
Demand Response Profile (14.5 MGal Demand)**

PG&E ID #3751780585
EID EDH WTP & Treated Water Pumping Facilities

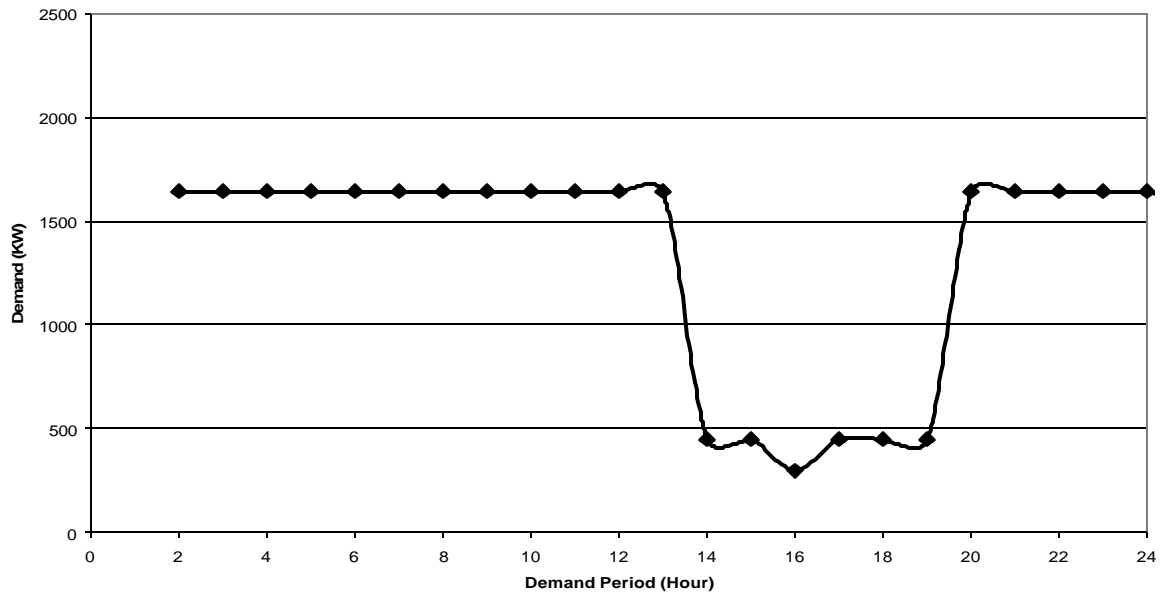


Recorded Electrical Use – September 15, 2004

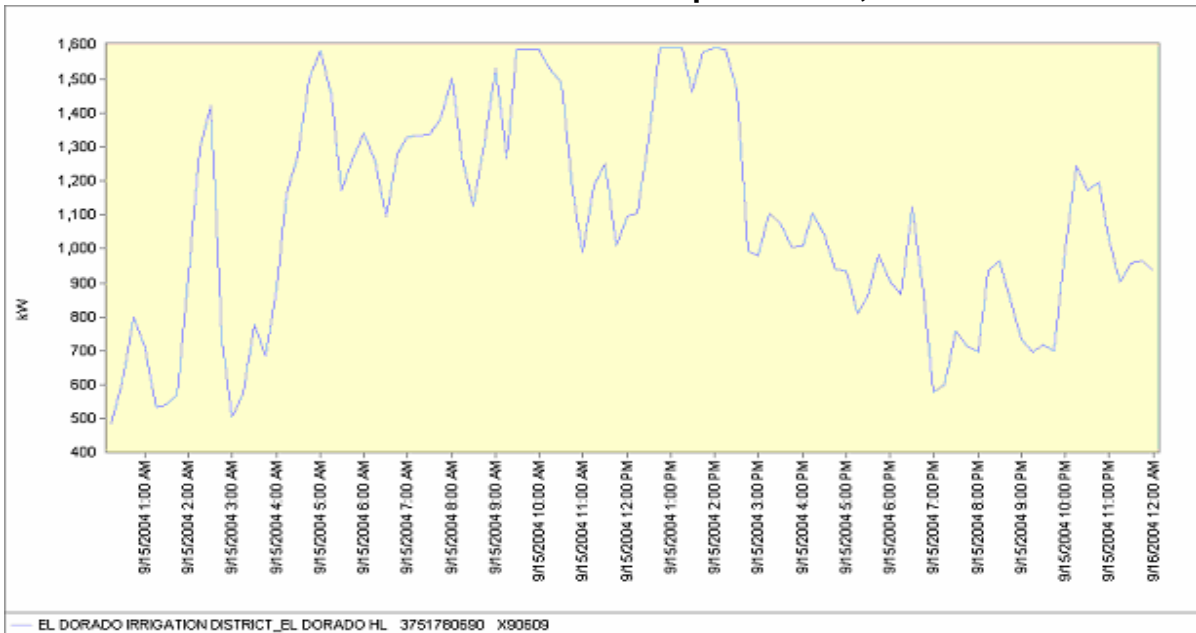


Folsom Lake Raw Water Pumping Station Hourly Electrical Demands Demand Response Profile (14.5 MGal Demand)

PG&E ID#3751780690
Folsom Lake Raw Water Pumping Station



Recorded Electrical Use – September 15, 2004

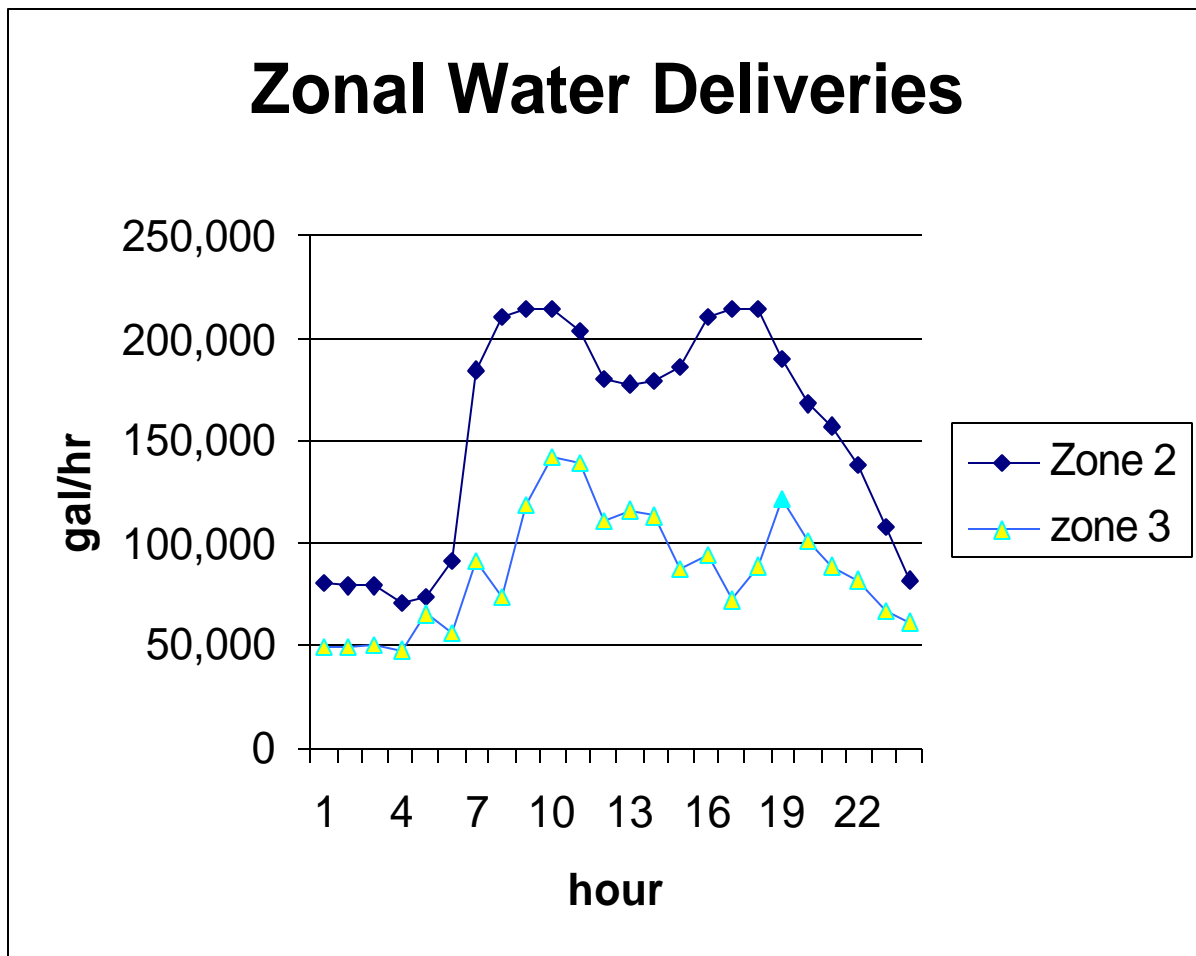


TOU Water Meter Proposal



- To CEC PIER Program
 - Inventory TOU water meter options
 - Develop TOU water tariffs
 - Install TOU meters on
 - Residential
 - Commercial / Industrial
 - Assess real-time meter changeout impact on wholesalers
 - Projected deployment by spring 2005
 - Interim report fall 2005
 - Final report fall 2006

If Water Agencies Can Get Customers To shift Demand, They Can Reduce Peak Usage



Water Agency Generation Opportunities



- Water agencies (exclusive of those selling retail electricity) already have about 1,500 MW of generation
- Water agencies are essential services, and have to have back up generation for critical loads
 - over 1/3 of all back up generation in the state is owned by water agencies
- Virtually all water treatment facilities are suitable for biogas generation
- Virtually all water agencies have potential for additional small hydro generation
- Institutional barriers have prevented development of this additional generation

Summary



- Water agencies are the single largest electricity end user in California
 - have the most potential to shift 1,000 MW+ of peak demands without disrupting service
 - have untapped generation potential of 1,000+ MW
- Drought significantly reduces hydro generation and increases pumping requirements
- Climate change may significantly reduce available water
- There is a lot of new water related electricity demand being developed that we haven't seen yet, and may see only occasionally